REMARKS

Claims 1-10 and 12 are pending. Claims 3, 5, 11 and 13 have been canceled without prejudice.

Claims 1 and 12 have been amended to recite the subject matter of canceled claims 3 and 5. Also, claims 1 and 12 have been amended to specify the methyl acetate content of the reaction mixture is from 2 percent by weight to 10 percent by weight. Support for this amendment can be found on page 21, lines 15 to page 22, line 1 of the present specification.

No new matter has been added by way of the above-amendment. In view of the above amendment, Applicant believes the pending application is in condition for allowance.

Prior art based issues

The following prior art based rejections are pending:

(A) Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hosono et al. (US 20060281944, US '944 *equivalent to JP2004277297)* in view of Scates et al. (US6303813, US '813 *equivalent to JP2003508363)* or Jones (US7098363, US '363 *equivalent to JP2002508759) all in IDS and ISR,* and further in view of Miura et al. (EP0687662, EP '662 *equivalent to US5625095 in ISR); and*

(B) Claims 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable as being unpatentable over US '944 in view of US '813 or US '363, further in view of EP '662, as applied to claims 1-7 above, and further in view of Cheung et al. (US7005541, US '541).

Applicants respectfully traverse both Rejection A and B.

M.P.E.P. § 2143 sets forth the guidelines in determining obviousness which take into account the factual inquiries set forth in *Graham v. John Deere*, 383 U.S. 1, 17, 148 USPQ 459, 467 (1966). A key component of this factual inquiry which the Examiner appears to not give

weight is the ***predictability*** of the art. The courts have recognized that inventors face additional barriers in relatively unpredictable technological areas as noted in *Takeda Chemical Industries, Ltd. v. Alphapharm Pty., Ltd.*, 83 USPQ2d 1169 (Fed. Cir. 2007) which dealt with the chemical arts. Combining known prior art elements is not sufficient to render the claimed invention obvious if the results would not have been predictable to one of ordinary skill in the art. *United States v. Adams*, 383 U.S. 39, 51-52, 148 USPQ 479, 483-84 (1966); *see also* M.P.E.P. § 2143.

Here, the inventive method for producing acetic acid uses a homogeneous catalyst which is very different from the method of US'944 and US'363 because the method of US'944 and US'363 uses a heterogeneous catalyst in the reaction. Applicants respectfully submit that one skilled in the art would not look to the parameters/components in a reference which describes a heterogeneous catalytic reaction and apply those parameters/components to a method taught in another reference which describes a homogeneous catalytic reaction, since doing so would be unpredictable and there would be no reasonable expectation of success.

In the case of a method utilizing solid catalyst (heterogeneous catalyst), first of all, starting materials are adsorbed on the surface of the solid catalyst. Next, the adsorbed materials undergo a reaction. On the other hand, in the case of homogeneous system, the homogeneous catalyst is dissolved in the liquid solution. This means that there is a difference in the reaction mechanism between the reaction using a homogeneous catalyst and the reaction using a heterogeneous one. It is inappropriate to discuss the reaction conditions mutually in the same way.

US'944 teaches that:

> a homogeneous catalytic reaction is not adapted to a high rate of reaction because of the solubility of the catalyst metal is low relative to the solvent so that a large reactor may need to be used as a matter of course. Additionally, water need to be contained in the reaction solution to a certain ratio in order to increase the reaction rate and the selectivity for acetic acid and prevent deposition of the dissolved catalyst and consequently it gives rise to hydrolysis of methyl iodide that is contained as promotor to reduce the yield and corrode the reaction apparatus. For these and other reasons, a method utilizing a heterogeneous catalytic reaction has been developed because it is relatively free from such problems. (See paragraph [0002]).

In other words, US'944 states that the homogeneous catalyst differs from a heterogeneous catalyst in the mechanism of the reaction. As such, it is improper to refer to the homogeneous reaction system and the heterogeneous reaction system as equivalents which can be readily interchanged, especially on the water content and the concentration of methyl iodide and so on.

In a method for producing acetic acid continuously by reacting methanol with carbon monoxide in the presence of a rhodium catalyst (homogeneous catalyst) as in the present invention, for example, the hydrogen partial pressure becomes low as the water content becomes low. However, such a low hydrogen partial pressure fails to ensure a sufficiently high catalytic activity in the production of acetic acid. And the production rate of acetic acid decreases at a low hydrogen partial pressure. Theoretically, one could increase the rhodium content to increase the production rate of acetic acid, but this would also increase the production rate of acetaldehyde to be substantially equal to that of acetic acid. Meanwhile, at a high hydrogen partial pressure, a reaction for producing methane is promoted, and water produced upon the by-production of methane must be removed. This requires extra energy and the addition of an agent for removing water which thereby reduces the production efficiency and increases the production cost of acetic acid (as shown in Table 1 of the present specification). Thus, when one of these demands is met, the other demands cannot be met.

As is stated above, a problem exists in the art for producing acetic acid efficiently. The present invention solves this problem for the first time.

To solve the problem, the inventive method involves accelerating the production rate of acetic acid while inhibiting by-production of acetaldehyde by increasing the CO partial pressure and the methyl acetate content. The by-product can be reduced (the production rate of acetaldehyde to 1/1500 or less the production rate of acetic acid) without reducing the production rate (11 mol/L • hr or more).

According to the present invention, because of specifying

(i) the water content of 3 percent by weight or less ,

(ii) the hydrogen partial pressure of 70 kPa or less,

(iii)the CO partial pressure of 1.05 MPa or more and

(iv)the methyl acetate content of 2 to 10 percent by weight

in a reaction mixture, the high-quality acetic acid can be produced efficiently for the first time.

US'944 discloses neither the concentration of methyl acetate nor the production rate of acetic acid. In addition, US'944 does not disclose how one would specify the production rate of acetaldehyde.

US' 813 defines neither the production rate of acetic acid nor how one would specify the production rate of acetaldehyde.

US'363 uses a heterogeneous catalyst and teaches that the production rate of rate of acetic acid with the methyl acetate of 10 percent by weight which is worse than the production rate of acetic acid with methyl acetate of 20 percent by weight (example 1). In addition, US'363 defines neither the production rate of acetic acid nor how one would specify the production rate of acetaldehyde.

EP'662 does not disclose the preferred extent of the CO partial pressure. In addition, EP'662 discloses that the reaction is carried out while removing acetaldehyde. Therefore, EP'662 does not conceive the idea of inhibiting by-production of acetaldehyde itself. Also, EP'662 does not define how one would specify the production rate of acetic acid.

US'541 does not disclose the CO partial pressure. Also, US'541 discloses that the hydrogen partial pressure is about 75 to 96 kPa (11 to 14 psi) (see the Examples and table 1). Additionally, US'541 discloses that the production rate of acetic acid is accelerated by using considerable catalyst. Therefore, US' 541 does not conceive the idea that the production rate of acetic acid is accelerated by specifying the CO partial pressure and the methyl acetate content. US'541 does not define how one would specify the production rate of acetaldehyde.

As is stated above, the reaction conditions specified in the claims of the present invention are not disclosed in these cited references. They are completely silent about specifying (i), (ii), (iii) and (iv) at the same time to accelerate the main reaction (11 mol/L • hr or more) while inhibiting side reactions (the production rate of acetaldehyde to 1/1500 or less the production rate of acetic acid).

According to the method for producing acetic acid of the present invention, the formation of by-products can be reduced without reducing the reaction rate of acetic acid even at a low water content and a low hydrogen partial pressure of the reaction system. High quality acetic acid can be efficiently produced. Furthermore, acetic acid can be efficiently produced in the inventive method with a high productivity using simple processes and facilities while inhibiting the formation of acetaldehyde and consecutive reaction products thereof.

Therefore, a person skilled in the art would not find the present invention obvious over the cited references. As such, reconsideration and withdrawal of Rejection A and Rejection B are respectfully requested.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Garth M. Dahlen, Reg. No. 43,575 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.147; particularly, extension of time fees.

Dated: February 26, 2009

Respectfully submitted,

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